155. *Electron Microscope Observation of the Motor Cell of Mimosa pudica L. I*

A Comparison of the Motor Cell before and after Stimulation^{*)}

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In previous papers, the motor tissue-cells of *Mimosa pudica* L. were compared before and after stimulation by classical cytological methods (Toriyama 1954, 1957, 1967a, 1967b, 1967c). Recently, some electron microscope observations of the motor cell of the *Mimosa* and physiological experiments upon it have been reported by Ljubimova (1964) and the present authors (Toriyama and Satô, 1968). In the present study, the fine structure of the motor cells will be reported, and more especially, the protoplasm and the tannin vacuole will be compared before and after stimulation under diurnal conditions.

Materials and methods. The young main pulvinus of *Mimosa pudica* L. used in this study was cultured in a pot in a greenhouse from 25° to 27°C. The material was fixed with a 1 per cent osmium tetroxide solution buffered at pH 7.2 with a phosphate buffer, dehydrated, and then embedded in methacryl resin by the standard procedure. Sections were examined with an electron microscope (an HS-type electron microscope of the Hitachi Company). In order to observe the motor cell before it received a stimulus, the plants were exposed to ether vapour for 25 to 30 minutes as usual.

Experimental results. The general structure of the motor tissue of the main pulvinus is cylindrical. The vascular bundle is surrounded by a thick parenchyma. The parenchymatous motor tissue develops concentrically. There are few differences, if any, between the upper and the under side of the motor tissue. As for the morphological differences, the cell wall of the parenchyma had an upper side thicker than its underside. The cells of the underside will be discussed chiefly in the present work. In a previous paper, which appeared last year, one of the present authors (Toriyama,

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Figs. 1-6. Motor cell of main pulvinus of *Mimosa pudica* L. before stimulation. 1. ta: tannin vacuole; cy: cytoplasm. $\times 5000$. 2. n: nucleus. $\times 6000$. 3. n: nucleus; to: tonoplast; cy: cytoplasm. $\times 5000$. 4. to: tonoplast. $\times 15000$. 5. ta: tannin vacuole; arrow indicates stripe pattern. $\times 5000$. 6. arrows indicate stripe pattern in tannin vacuole. $\times 15000$.

Figs. 7-13. Motor cell of main pulvinus of *Mimosa pudica* L. after stimulation. 7. to: tonoplast; arrows indicate crushed tannin vacuoles. $\times 5000$. 8. n: nucleus; arrows indicate crushed tannin vacuoles. $\times 6000$. 9. to: tonoplast; ta: tannin vacuole; arrows indicate crushed tannin vacuole. $\times 5000$. 10. asterisks indicate fragments of protoplasmic components. $\times 10000$. 11. to: tannin vacuole. $\times 10000$. 12. ta: tannin vacuole; co: aggregation of contents of central vacuole. $\times 10000$. 13. to: tonoplast; asterisks indicate fragments of protoplasmic components. $\times 10000$.

Fig. 14. A part of the motor cell before stimulation. co: contents of central vacuole; to: tonoplast. $\times 10000$.

Fig. 15. A part of the motor cell after stimulation. co: aggregated contents of central vacuole; to: tonoplast left from cytoplasm and cell wall. $\times 10000$.

1967a) found, by the application of the Kaiser-toluidine blue technique, that there were some motor cells with tannin vacuoles and some without them. Mainly motor cells which have tannin vacuoles are examined in the present investigation.

The electron micrographs of the motor cell of the main pulvinus before stimulation are shown in Figs. 1 to 6, and in Fig. 14. In the motor cell the cytoplasmic layer (cy) exists at the periphery of the cell (Figs. 1 and 3), and the tonoplast (to) is clearly observable (Figs. 3 and 4). This thin tonoplast is about $50\text{ m}\mu$ thick. Therefore, before stimulation, the large tannin vacuole is spherical in contour and is an electron dense body (Fig. 1, ta). Sometimes, in other motor cells, tannin vacuoles appear as is shown in Figs. 5 and 6, as diffused electron dense bodies. Let us note here that the stripe pattern is observed in these tannin vacuoles, as is indicated by the arrows (Figs. 5 and 6). Furthermore, before stimulation each motor cell has a round nucleus (Figs. 2 and 3) and includes diffused fine contents in the central vacuole (Figs. 1, 3, and 14).

The electron micrographs of the motor cell after the stimulation are shown in Figs. 7 to 13 and Fig. 15 under these conditions, the tonoplast was separated from the cytoplasm and cell wall (Figs. 7, 9, and 15). Thus the fragment of cytoplasm is gathered near the crushed tonoplast (Figs. 7, 9, and 13). Furthermore, under the same conditions tannin vacuoles were crushed and become electron dense bodies, as is indicated by the arrows (Figs. 7, 8, and 9). Occasion-

ally, aggregated protoplasmic components appeared near the crushed tannin vacuole (Figs. 9 and 11). From the above-described phenomena, the present authors have concluded that the tannin vacuole and the protoplasm must have reacted with each other; i.e., biological tanning occurred upon receipt of a stimulus. Then, as is indicated by the asterisks, some cells after stimulation showed crumbled cytoplasm near the thread-like feature (Figs. 9 and 10). Furthermore, under the same conditions each motor cell had a shrunken nucleus (Fig. 8), and aggregated contents appeared remarkably in the central vacuole (Figs. 12 and 15). The present authors consider that the change of the colloidal state; i.e., reaction of sol to gel occurs upon change of the colloidal state; i.e., reaction of sol to gel occurs upon receipt of a stimulus.

As has been mentioned above, differences among several cellular elements of the motor cell between before and after stimulation can be observed. It is expected that the structure of the protoplasm and the contents of the central vacuole of the motor cell will be elucidated in more detail in future research.

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